DOCUMENT RESUME

ED 225 810 SE 039 841

AUTHOR Bodine, Richard; And Others
TITLE MEGSSS: An Evaluative Study.
INSTITUTION CEMREL, Inc., St. Louis, Mo.
PUB DATE Feb 82
NOTE 73p.
AVAILABLE FROM MEGSS National Model project, CEMREL, Inc., 3120 59th Street, St. Louis, MO 63139.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Academically Gifted; Educational Research; *Evaluation; *Gifted; *Mathematics Instruction; Program Descriptions; Secondary Education; *Secondary School Mathematics
IDENTIFIERS Mathematically Gifted; Mathematics Education Research; *Project MEGSSS

ABSTRACT

The stated purpose of the Project for Mathematics Education for Gifted Secondary School Students (MEGSSS) is to provide an instructional program for gifted students utilizing the Elements of Mathematics (EM) Program, a curriculum specifically designed for students with superior reasoning ability in mathematics. This report is the result of an external evaluation of MEGSSS. The material is divided into three major sections. The first is MEGSSS: Mathematical Content and Its Treatment for the Gifted Child. This portion starts by defining gifted and talented children and discusses the objectives of the EM program. Part 2 is MEGSSS: Program Operations and Logistics. The section covers: (1) Background; (2) Identification; (3) Dropouts; (4) Students Still Participating in MEGSSS; (5) Parents and MEGSSS; (6) The Educational Community and MEGSSS; and (7) Teachers and MEGSSS classes. The final section, Recommendations and Replicability, opens with a discussion of some basic issues. Individual topic sections focus on: (1) Teacher Training; (2) Local School Districts and University Involvement; (3) Student Selection and Funding; (4) Program Logistics and Attrition; and (5) Curriculum Alternatives. The document closes with a summary. Strengths and weaknesses are noted, and hope is expressed that the program will continue. The MEGSSS model is viewed as worthy of replication. (MP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

J Scaggs

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SETTING FOR THE EVALUATION

Project MEGSSS (Mathematics Education for Gifted Secondary School Students) was established in 1978 at CEMREL, Inc., which is one of the national educational laboratories supported by the National Institute for Education (NIE). Its purpose is to provide a mathematics instructional program beginning in seventh grade to gifted mathematics students from participating school districts in the Metropolitan St. Louis area. Students attend classes held at the MEGSSS center at the end of the school day, two hours at a time and twice a week. The curriculum is the Elements of Mathematics, a grades 6-12 program developed at CEMREL especially for gifted students.[1] MEGSSS replaces the regular mathematics program at the students' home schools.

In 1979, the project moved to offices and classrooms in a local school district and in December, 1979, CEMREL received funds for the support of MEGSSS for two years, through November 1981. Since then, MEGSSS has become an independent corporation with a board of directors composed of parents of MEGSSS students.

Part of the support given by CEMREL to MEGSSS consisted of research and evaluation support including assistance in the identification of students for the program. This report is the result of an external evaluation of MEGSSS conducted by CEMREL's Mathematics Research and Evaluation Studies program.

---

[1] A description of MEGSSS can be obtained from:

MEGSSS National Model Project
CEMREL, Inc.
3120 59th Street
St. Louis, MO 63139

The three outside reviewers were:

Richard Bodine (chairman), Principal, Leal School, Urbana Public Schools

Arnold Ross, Professor Emeritus of Mathematics, Ohio State University

Thomas Gill, Supervisor, Office of Mathematics K-12, Baltimore County Public Schools

Among them, these three reviewers have considerable experience in the selection of gifted students, the development and implementation of programs for gifted students, and the evaluation of such programs, both in mathematics and other areas. All are currently active in this field. In particular, all have worked in the classroom with junior high students who are gifted in mathematics.

The reviewers visited St. Louis on two occasions; October 25, 26, 1981 and November 2-4, 1981. During this time, either separately or together, they observed MEGSSS classes at all levels (including a fourth year class in the process of discussing a special set of mathematics problems developed by Dr. Ross), and interviewed a great many people, including:

- School administrators and mathematics supervisors (from both participating and non-participating school districts),
- MEGSSS teachers,
- MEGSSS board of directors and parents,
- Present MEGSSS students and former students who had dropped out of the program,
- Former MEGSSS teachers from local colleges.

They also reviewed many program documents including vitas, promotional materials, communications with school districts and parents, reviews of the EM curriculum, descriptions of selection procedures, all previous evaluation reports, written parent and student questionnaires, and of course, the EM materials themselves.

The two main objectives of this work were to:

a) evaluate the instructional program at MEGSSS and make recommendations about future directions of the project, and

b) evaluate the replicability of MEGSSS as a model for instruction of gifted students in other places.

The reviewers are to be commended for the thorough and conscientious job they have done. In my opinion, this report deals in a fair and thoughtful manner with the important questions about MEGSSS.

Martin Herbert
Director,
Mathematics Research
and Evaluation Studies
CEMREL, Inc.

TABLE OF CONTENTS

Introductory Comments. 1

MEGSSS: Mathematical Content and its Treatment for the Gifted Child. 4

MEGSSS: Program Operations and Logistics. 11

Background. 11

Identification. 12

Drop-outs 20

Students Still Participating in MEGSSS. 27

Parents and MEGSSS. 35

The Educational Community and MEGSSS. 44

Teachers and MEGSSS Classes 48

Recommendations and Replicability. 52

Teacher Training. 55

Local School Districts and Local University Involvement 57

Student Selection and Funding 60

Program Logistics and Attrition 61

Curriculum Alternatives 62

Summary. 65

INTRODUCTORY COMMENTS

The stated purpose of Project MEGSSS (Mathematics Education for Gifted Secondary School Students) is to provide an instructional program for gifted students utilizing the Elements of Mathematics (EM) Program, a curriculum specifically designed for students with superior reasoning ability in mathematics.

In making an evaluation study of a program which is directed to the mathematically talented, one must attempt to delineate clearly the underlying assumptions and/or the biases of the individuals and/or the group conducting such a study.

First, we do support the view that effective talent search and development are critically important for the welfare of our nation. (A. E. Ross, Chapter V, Science and Technology Policies, Ballinger Publishing Co., 1973.) We believe that the educational community is morally obligated to provide differentiated educational programs and/or services beyond those normally provided by the regular school program in order that gifted and talented children may realize their potential to self and society. We do applaud MEGSSS as an attempt to address this obligation.

Second, we recognize that the present form of MEGSSS both as regards the mathematical content as well as the methods of implementation is primarily the work of Burt Kaufman. Burt's immense dedication, his unusually wide experience, his ability to attract the help of many able mathematicians and, last but not least, his deep affection for young people in which they reciprocate very warmly--all these traits have been fundamentally responsible for the existence of the present consitution of MEGSSS.

It is the fundamental importance of the MEGSSS objectives, and the existence of MEGSSS as a significant entity striving to meet these objectives, that make it worthwhile to undertake this searching examination of its current status. Those objectives are implied in the following listing of advantages of Project MEGSSS (MEGSSS Brochure):

For students: To study high quality mathematics and to accelerate their study of mathematics,

to interact with other gifted students and yet remain within the geographic, social and chronological environment of their peers,

to meet an intellectual challenge beyond what they are accustomed to find in their school program, and

to earn up to thirty-two semester hours of college credit.

For parents: to enrich the academic program of their gifted children, and

to provide a substantial portion of their children's college education at far less expense.

For the schools: to provide a strong program for an important group of students whom they are not able to serve as well by other means.

For society: to respond to the serious shortages in scientific personnel projected for the decade ahead by a national manpower commission, and

to have this type of program replicated nationally.

Our examination entailed a review of the EM materials, MEGSSS operations materials, data collected from parents and students and about students, and other evaluation reports on MEGSSS; interviews with MEGSSS staff members, CEMREL personnel, parents, MEGSSS Board Members, public school and university personnel, and present and former MEGSSS students; and MEGSSS classroom observations.

Although the many facets of the MEGSSS Program and its work with the gifted are closely related, it seems desirable to focus this report on each of what seems to be the fundamental components one at a time.

What follows, then, is the composite view of the site visit evaluation team. The first portion of the report is our view of MEGSSS as it operates in St. Louis and the second portion will address the replicability of MEGSSS as a delivery model. The first portion is, as would be expected, the most extensive. It consists of our observations and our perceptions of MEGSSS. The various sections of this first portion, although treated separately, are intricately interwoven and interdependent. In order to hold redundancy to a minimum, the various sections are not written to be extracted separately as autonomous reports. The second portion, although it may or may not have implications for MEGSSS, is directed toward those who would attempt to implement a program of mathematical study for highly gifted students.

MEGSSS: MATHEMATICAL CONTENT AND ITS TREATMENT FOR THE GIFTED CHILD

For the purpose of this evaluation report, we define gifted and talented children as those identified by professionally qualified persons who, by virtue of outstanding abilities, are capable of high performance. These are children who require differentiated educational programs and/or services beyond those normally provided by the regular school program in order to more fully realize their potential contributions to self and society. The population included in this definition is approximately 3 to 5 percent of the school population nationally per curricular area.

The objectives of the EM program (MEGSSS in Action by Kaufman, Fitzgerald, and Harpel, CEMREL, Inc., 1981, pages 4-5) are consistent with the characteristic traits of gifted and talented children. In particular, the power of abstraction, critical thinking, and creativity are emphasized. The EM program is designed to help students to fulfill their own potential rather than satisfy the demands of others for their talents. The development of thinking processes and the quality of performance are stressed. In addition to the stated EM Program goals, the program does focus on the first three recommendations in An Agenda for Action (1980s) as published by The National Council of Teachers of Mathematics. Problem solving, an expanded definition of basic skills, and the power of calculators and computers are addressed in the EM Program. The operational success of the EM Program in reaching the stated objectives and/or the degree to which the EM materials addresses the recommendations are, of course, subjects of varied interpretations.

Nevertheless, the EM Program is unquestionably a qualitatively, and for that matter quantitatively, differentiated program designed for gifted and talented students. The program is a highly structured, unified six-year development that presents mathematics in a logical, rigorous, and sophisticated fashion. It challenges the learner to think and to develop powers of abstract and precise reasoning. It gives the learner experience with a wide range of mathematical systems.

The question of the proper balance between abstraction and formality on the one hand and application and intuition on the other is a most critical factor in evaluating the appropriatness of the EM materials for use in a program such as MEGSSS. By our way of thinking, the Book 0 material is the most interesting and reflects the active involvement of students in learning the essence of the discovery process. This early mathematics clearly stresses intuition and informal exploratory learning. The teaching style is inductive--a fact easily observed in the MEGSSS classes. In Book 0, particularly in the early chapters, mathematical ideas are abstracted from interesting, relevant problem settings. The later books, however, seem to depart drastically from this theme and might be construed as teaching sterile formal manipulations. There is concern about the heavy emphasis on formal logic in the program. Will there be transfer of understanding from nontrivial applications to problem solving in its broader sense? (The class session with the fourth year MEGSSS students dealing with the problems submitted by Dr. Ross provided one operational example that would provide an affirmative answer to this question.) There needs to be a balance between abstraction and application. Students need to experience the power and rigor of mathematics, but also the beauty of inductive development. Students should have expanded opportunity to practice using basic mathematics outside the context of the EM material. It is possible that the heavy emphasis on formal logic in developing the subjects treated in the EM Program deprives students of sufficient time spent on solving problems.

The EM Program uses several notational variances as pedagogical aids. Some of these are perhaps carried a bit too far. On the other hand, it may be a valid argument that since the students have probably mastered many of these skills, or at least have an intuitive understanding of them from earlier works, the fresh

approach gives them another perspective. Our observations would certify that the nonstandard notation does not appear to present any difficulty for the participating student. It is, however, a rather favorite point of criticism from the educator who is non-supportive of the program, either MEGSSS or EM or both.

There appears to be little attention paid to Geometry throughout the EM Program. We realize that Books 12 and 13 deal specifically with geometrical topics; however, some of the standard Euclidean concepts such as circle are omitted. There appear to be missed opportunities to give visual background and application for many of the abstract algebra ideas. The EM materials appear to reflect a definite bias toward abstract algebra and underplay the importance of geometric imagery and problems.

Of course, the texture of written exposition does not always determine completely what takes place in the classroom. For example, the University of Illinois (U.I.C.S.M.) materials were rather on the formal side. Nevertheless Max Beberman's masterly performance in the classroom always assured a deep involvement of his students in the process of discovery of the significance of new ideas rather than their acceptance by virtue of the teacher's compelling logical reasoning.

We think that when a teacher's work is based upon a tightly structured text-book in which mathematics is presented in supposedly "the best" manner which is to be emulated, then, unless the teacher is very experienced, the result is likely to be indoctrination rather than enlightment. In such circumstances students will do many mathematical exercises but will not gain adequate experience in the art of concept analysis and of the related skill of problem solving. Problem solving can

be a very effective tool for bringing within the reach of students an appreciation of subtle mathematical ideas (cf. Arthur Engel, Mathematische Schulerwettbewerbe, Jahrbuch Uberblicke Mathematik, 1979, Wissenschaftsverlag Bibliographisches Institut, Manheim.)

We agree that there are many ways in which one can augment the ensemble of the very basic mathematical skills when one works with the eager and talented students and when the time of the teacher-student association spans the period of four to six years. The nature of such augmentation depends largely upon the group of mathematicians involved in the design of a given program. It would appear to be highly desirable to encourage significant variations to be proposed and executed by other accomplished university colleagues who can be induced to participate in the program from time to time. We believe this is possible even if the proposed content is encoded in a written text. The extent of variations can vary from one instance to another.

The following is an almost random listing of a few possible variations of the EM texts used in the MEGSSS program:

1. An intuitive preamble to Book 9 could be done using intuitive vector geometry as in Mathematics Student when it was edited by Max Beberman. One can do interesting things with complex numbers at this stage.

2. Intuitive introduction to sets and Boolean algebra can be done as in "Toward the Abstract" in Mathematical Spectrum 1978.

3. Intuitive number theory could be done using a more natural way of writing an integer to a given base and Euclidean algorithm could be introduced much earlier together with continued fractions and a much better treatment of linear Diophantine equations.

4. There is considerable advantage in ordering fields by the choice of a "set of positive elements".

5. There is something to be said about introducing $\ln_x$ directly through a definite integral.

6. Intuitive introduction to probability is very fine. Book 11 is a bit stiff. Should one move to measure theory or use probability to acquire rich mathematical experience other than measure theory?

7. One can provide an arithmetic - algebraic treatment of the canonical forms of linear transformations, a treatment which leads naturally to algorithmic considerations and which is very accessible to the very young.

One can continue this list of small and large suggested variations indefinitely. This does not mean that one should rewrite the text. On the contrary, if a thoughtful mathematics colleague should exhibit a treatment or discuss a topic different from one in the text, talented students will realize that there are usually alternative ways of viewing even familiar things and that there is more to mathematics than what appears in the text. They should find such an experience very exciting.

The students in the MEGSSS Program give a favorable reaction to the EM materials. These students have most likely no experience with other mathematics curriculum materials to make comparisons. They have experienced, for the most part, the typical elementary mathematics curriculum and followed that with involvement in MEGSSS. For most of the chapters of Book 0, Chapters 1-10, and Book 1, 20%-40% of the students thought the topic was "very interesting" and 10%-20% thought the

topic was "not very interesting" (though 95% thought Book 1 and 75% thought Book 0, Chapter 8 was "very interesting" while 25% thought Book 0, Chapter 5, and Book 0, Chapter 10, were "not very interesting"). In reporting positive features of the MEGSSS Program, 26% of the parents of students continuing in the program mentioned the material or content as one of the positive features, second only to 57% who said the program was challenging--a feature that most likely is related to content. Even 11% of the parents of students who dropped out of MEGSSS mentioned the material or content as one of the positive features. (MEGSSS Evaluation Status Report, Herbert, CEMREL, February 1981). Comments such as "I believe it is a very good math program," "It offers a much broader exposure to mathematics," "These are very good materials," and "Stimulating and challenging materials form the basis of the program," appear frequently in the student and parent questionnaires. Positive reactions to the EM materials were also offered in our interviews with parents, students, and supportive school personnel. However, these reactions were usually not the first point of positive assessment offered. It was usual for the "opportunity to work with peers" or "opportunity to be challenged by good, interested teachers" to come out early in such discussions.

The most consistently negative assessments of the MEGSSS Program attributed to the use of the EM materials came from educators, most notably mathematics educators, in the non-participating school districts and at Webster College. These negative assessments usually involved such things as too rigorous, too abstract, non-standard and too much notation, lack of mathematics basics and application of those basics, lack of problem solving, lack of practice with algebraic skills, etc. An equally significant, or so it appeared, reason given for rejecting MEGSSS and the EM materials was that the order of the topics studied was so unconventional that if a student dropped out of MEGSSS he/she could not easily fit into the advanced track at his/her home school.

In summary, we find the EM materials to be appropriate for gifted and talented mathematics students. The EM program is an excellent one in that it "challenges" students to think and develops the nature of mathematical reasoning. Even with our concerns previously stated, tha fact remains that there does not exist another curriculum program that is as demanding for gifted and talented students as is the EM Program. However, it is further our belief, that the materials can be modified or even supplanted with other materials. This may be a necessity for insuring the success or acceptance of a program such as MEGSSS. These issues will be addressed later in this report, but one of the major concerns that might suggest the need for modification is the availability of qualified teachers. To be able to effectively teach the materials beyond the early chapters of Book 0 requires training beyond what most secondary mathematics teachers have received. Another concern is they probably need to obtain some support, likely monitary from the local school districts. This support may require curricular concessions.

MEGSSS: PROGRAM OPERATIONS AND LOGISTICS

Background: Project MEGSSS operates in the St. Louis metropolitan area. This area has twenty-five independent school districts and numerous private and parochial schools. The relatively small size of most of these districts and/or schools makes it extremely difficult for them to provide an adequate program for a small number of gifted students. There is little or no reason to suggest that the St. Louis metropolitan area is unique in this regard. Several other metropolitan areas exhibit school and pupil distribution patterns similar to those of the St. Louis area. Even areas not generally thought of as metropolitan may have two or more school districts within a geographical proximity that would not preclude cooperative ventures to meet the needs of the gifted child. (Cooperative agencies for the delivery of special education services to the handicapped are quite common even in remote rural areas.) Project MEGSSS removes the economic burden of providing a specialized mathematics curriculum for a very small number of gifted students from the individual school or district, and provides the school or district with a means of meeting the real needs of these students.

MEGSSS attends not only to the mathematical content but also to the social needs of gifted secondary school students by providing an opportunity for gifted students to come together with their peers in an intellectually stimulating setting without removing them completely from the social setting of junior high and high school. (MEGSSS in Action by Kaufman, Fitzgerald and Harpel, CEMREL, Inc., 1981, pages 11-13.)

Students who are selected for the MEGSSS Program and who elect to participate, attend classes two mornings per week for six weeks during the summer prior to their first school year of participation. This is usually the summer between the student's

sixth grade and seventh grade year. Starting in September, and generally thereafter, the student attends a MEGSSS class two days per week from 3:00 p.m. to 5:00 p.m. The MEGSSS class is taken in lieu of the student's regularly scheduled mathematics class in the home school. The student usually has two or three hours of homework for each two-hour class.

Identification: Project MEGSSS identifies and selects students according to the following procedure. Each fall, all participating school districts and private and parochial schools nominate sixth-grade students (plus exceptional fifth graders) from their schools to participate in Project MEGSSS. Schools are advised to nominate students who are at or above the 98th percentile in mathematics and the 95th percentile in reading on the school's regularly administered standardized test and who display such traits as persistence, curiosity, perception, superior reasoning ability, originality, motivation, independence, social maturity, emotional stability, and enthusiasm for mathematics.

After the nominations are received, parents are invited to an orientation meeting at which time the program is explained in detail and questions answered.

At Project MEGSSS, nominees wishing to be considered for admission take a three-hour test battery that includes the mathematics subtest of the Scholastic Aptitude Test (SAT, normally administered to college-bound juniors and seniors), the Watson-Glaser Critical Thinking Appraisal, a test on logical reasoning, and a test involving complicated arithmetic word problems. Nominees are also asked to complete a questionnaire that probes their interest in and suitability for Project MEGSSS.

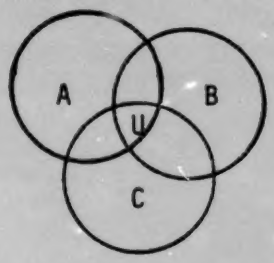
After the test results and completed questionnaires are evaluated, students under consideration are requested to come in with their parents for a personal

interview and are informed of their acceptance status either during the interview or shortly thereafter.

The schools are then notified so that schedule adjustments can be made. (MEGSSS Brochure)

In identifying gifted and talented children for special educational opportunities, it is probably best to err in the direction of over-selectivity. That is, it is better to select children for the special program who have a high probability of success rather than to select children with marginal probabilities of success and then place them in a situation in which they are likely to be unsuccessful. This is particularly true for a program like MEGSSS which is specific and relatively inflexible in its offerings and expectations. Thus, selection becomes the classic problem of determining that combination of criteria which will maximize the number of "successful" students while at the same time minimize the number of "unsuccessful" students.

The selection process employed by MEGSSS appears to parallel the Individualized Educational Programing Model--The Renzulli Triad. (Renzulli, J.S. The Enrichment Triad, Creative Learning Press, 1977.)



A is high ability
B is task commitment
C is creativity
U is group identified to participate

Students that are truly gifted and talented in mathematics and who would stand a good chance of being successful in MEGSSS appear to possess high ability

in general and in mathematics in particular, high task commitment to mathematics, and creativity. Psychometric, developmental, performance, motivational, and sociometric information should be utilized for screening and selection of students for such a program. Therefore, sources of information could well include test scores, teacher and parent ratings, product analysis, classroom achievement, self-expression, and peer nomination.

There is the very real possibility of unnecessarily excluding students from a program like MEGSSS by relying too heavily on test scores. Utilizing the SAT-M, for example, as the principal criterion for selection will probably decrease minority participation. This seems to be borne out by the present constitution of the student population of MEGSSS which is noticeably lacking in minority group representation.

The MEGSSS Program has refined the selection criteria each year apparently mostly as a result of correlational studies between the composite admissions score and success in the MEGSSS program. Success in MEGSSS can be thought of either as how well students scored on the EM curriculum tests or whether or not the student is still in the program.

Perhaps the best group to study is the 1979 group, which had a fairly large number of beginning students (unlike 1978) and who have completed enough of the curriculum to have a reasonable track record (unlike 1980). Before doing so, it is important to point out that the patterns of relationships between admission test scores and success in MEGSSS are rather different for the 1979 group than for the other two groups, for which one can summarize as follows:

- 1978 group, original n = 48, mean composite admission score = 636[1].
  1980 group, original n = 87, mean composite admission score = 607[1]

- For both groups, there was a low correlation between composite admission score and average MEGSSS score (r = .19 and .21 respectively).

- For both groups, cutoff scores can be found which provide some differentiation of students as to whether or not they dropped out of the program. Thus:
  Of the 1978 group, 90% of the 30 students with composite score < 670 dropped out.
  but 50% of the 16 students with composite score > 670 dropped out.
  Of the 1980 group, 80% of the 15 students with composite score < 550 dropped out.
  but 27% of the 22 students with composite score > 621 dropped out.

Although the cutoff scores are different for the two groups (perhaps due to different circumstances, ability levels, length of time in MEGSSS, etc.), they do function in that one has very different expectations regarding retention in the program for students <u>above</u> the cutoff than for students <u>below</u> the cutoff. This would say that composite scores are effective selectors.

For the 1979 group, the correlation between composite admission score and average MEGSSS score was higher, .41, but cutoff scores could not be found which differentiated students as effectively as to their likelihood of dropping out. However, if this group of students is partitioned according to composite admission score, one can look at average achievements and probability of still being in the program for each group. This is done in Table 1, below.

---

[1]The 1979 applicant group, with mean = 500 and standard deviation = 100, was used as a "norming group".

Table 1

Achievement and Drop-out Rate
By Composite Score Level, 1979 Group

Average Composite Admission Score	Number of Students	Average MEGSSS Test Score	Percent of Students Still in MEGSSS (after 1 year)	Percent of Students Still in MEGSSS (after 2 years)
< 545	37	77.4	40	19
545-615	37	81.9	51	19
> 615	29	85.7	38	21

Surprisingly, students with high composite admission scores are no more likely to remain in the program than are students with relatively low admission scores, even though they do better in the MEGSSS tests. This situation was clarified somewhat by looking at the percent of students still in the program at the start of the second year as a function of both admission scores and MEGSSS achievement scores. This is done in Table 2.

Table 2
Percent of Students Still in MEGSSS
by Ability and Achievement Levels, 1979 Group (after 1 year)

Average Composite Admission Score	Average MEGSSS Achievement Score		
	< 77	77-84	> 84
< 545	1/18 = 06	7/15 = 47	9/10 = 90
545-615	2/8 = 25	8/16 = 63	8/15 = 53
> 615	2/6 = 33	2/8 = 25	8/18 = 44

It is instructive to compare students with low admission scores (the first row) and students with high admission scores (the third row).

For low admission scores: almost all who had low achievement scores dropped out and almost all who had high achievement scores (though less numerous) stayed in.

For high admission scores: only between 1/4 and 1/2 of the students remained in the program, and this proportion didn't seem to depend much on how well they were achieving.

Or alternatively:

For low admission scores: few (23%) get high MEGSSS scores but all of these stay in the program.

For high admission scores: most (53%) get high MEGSSS scores but less than half of these stay in the program.

The conflicting results between 1978 and 1980 versus 1979 leave one in somewhat of a quandry. On the one hand (1978, 1980), composite scores don't predict MEGSSS scores particularly well but predict drop-out rates somewhat better. On the other hand (1979), composite scores do predict MEGSSS scores adequately, but are almost useless in predicting drop-out rates.

It seems that higher admission scores, or ability, make a difference under some circumstances, but for students above a certain level of ability, motivational factors rather than achievement in MEGSSS may play the most important role in determining whether or not a student will remain in the program. In an effort to determine whether questionnaire data would help in predicting drop-

outs, all 1979 questionnaires of MEGSSS students were coded on nine variables and correlations calculated between variable score and whether or not the student remained in MEGSSS (the point-biserial coefficient). These correlations were always positive but low - but no lower than when admission test scores were correlated with remaining-in-program. The only instances of correlations above .2 are shown below.

	Boys	Girls
Amount of education of mother	.04	.22
Amount of education of father	.03	.25
Student's ability to write effectively	.25	.05
Effort put forth by student in completing questionnaire	.02	.24

These are weak relationships, but given the unpredictability of drop-out rates and the usually low correlations between questionnaire data and anything else, the differences between boys and girls are striking.

It is also worth noting that there is some evidence of differential prediction of MEGSSS achievement scores for boys and girls, from admission test scores, as shown in Table 3.

Table 3
Correlations Between MEGSSS Achievement Scores and Various Admission Tests

	1978 Group		1979 Group		1980 Group	
	Boys	Girls	Boys	Girls	Boys	Girls
SAT	.24	.09	.50	.34	.18	.22
Math Aptitude	NA	NA	.33	.24	.02	.00
Watson-Glaser	NA	NA	.03	.32	.03	.34
Syllogisms	.12	.25	.03	.43	.29	.00

The data from the 1979 group (probably the most reliable data) shows that for boys, the two mathematically oriented tests have reasonable correlations and the verbally oriented tests virtually zero correlation with MEGSSS achievement. For girls, however, the verbally oriented tests are a little more effective. This finding is supported by the 1978 data, but not by the 1980 data. (MEGSSS Evaluation Status Report, Herbert, CEMREL, February 1981.)

The forgoing data certainly do not present a clear cut case for recommending the current identification process used by MEGSSS. It does, we believe, raise some points for further study.

The use of a 10-item teacher rating scale (completed by a teacher at the student's home school) was discarded as a part of the selection process because it did not differentiate between successful and unsuccessful students. It is also reported by the MEGSSS staff that the interview is used almost exclusively to inform the prospective student and parents about MEGSSS and is not useful as a data source to be used in the selection of students. Further, since the nomination guidelines are only suggestions and since anyone nominated may take the MEGSSS admission tests and since about twice as many students take the admission test as are admitted to MEGSSS each year, it appears that the identification process is almost exclusively psychometric. This is, undoubtedly, a significant factor in the lack of a more representative population in MEGSSS.

If the intent of such a program as MEGSSS is to find some students who are capable of success with the EM materials in a MEGSSS type program, the present selection process is probably as good as any. If, however, one of the intents is to find as many as possible of the students who could be successful, and we believe that should be one of the intents, the selection criteria need be

expanded beyond the psychometric dimension. Further, the initial nomination suggestions need also to include criteria other than the 95% in reading achievement and 98% in mathematics. This, we believe, is particularly crucial in finding gifted minority group students.

Drop-outs: Table 3 below summarizes the drop-out situation in the MEGSSS program:

Table 3

MEGSSS Drop-out Summary		1978 Group	1979 Group	1980 Group
First Year:	Entered in Fall	48	114	85
	Dropped within 12 months	22	54	34
	North County[1]			[7]
	% drop-out	$\frac{22}{48}$ = 46%	$\frac{54}{114}$ = 47%	$\frac{34}{78}$ = 43%
Second Year:	Entered in Fall	26	61	44
	Dropped within 12 months	12	27	
	North County[1]		[11]	
	% drop-out	$\frac{12}{26}$ = 46%	$\frac{27}{50}$ = 54%	
Third Year:	Entered in Fall	14	23	
	Dropped within 12 months	2		
	% drop-out	$\frac{2}{13}$ = 15%		
Fourth Year:	Entered in Fall	11		

[1] Not counted in the percentages is a group of 18 students from North St. Louis County which dropped out of MEGSSS so that a separate, independent program could be established closer to their own districts. If counted as drops, the percentages would be higher than shown. If counted as still in (same program), the percentages would be lower than shown. At the time of the site evaluation, it appeared that the North County program was either no longer in operation or such a significant departure from MEGSSS that the students could be considered drop-outs, although perhaps by collective choice rather than individual choice.

Data have been collected to attempt to ascertain the reasons for the drop-outs. Every student who dropped out (except the 18 from North County) received a questionnaire. The questionnaire was returned by 62 of the 128 drop-outs (48%).

The following is a summary of the responses to some of the questions that we believe are of some interest in trying to understand the attrition rate of the MEGSSS program:

1. On the average, about how much time did you spend each week on MEGSSS work, outside the time you spent in the CEMREL classroom?

   Was this more or less than you expected when you began MEGSSS?

The responses are shown below.

Number of Hours	Number of Students	More than Expected	Less than Expected
1	5	--	4
2	8	4	2
3	11	6	4
4	14	9	4
5	8	5	2
6	3	3	--
6	6	5	--
Total	55	32	16

The average number of hours was 3.7 which is about an hour more than the average reported by those still in the program. Also, the proportion of students reporting "more than expected" was about double the proportion for continuing students.

5. Would you have preferred to have MEGSSS in your own school as part of your regular daily schedule, instead of 2 or 3 days a week at the MEGSSS center?

Eighty-seven percent would have preferred MEGSSS at their own school. Of these students, 79% said they would have remained in MEGSSS had this arrangement been possible.

6. Do you think your time in MEGSSS is helping you in the following ways?

	Helped a lot	Helped a little	Did not help
Reading with better understanding	14	61	24
Taking notes more efficiently	30	37	33
Organizing your thoughts better	44	48	11
Budgeting your time more usefully	33	45	22
Communicating more clearly (i.e., speaking and writing)	13	45	42
Learning how to think about mathematics	74	19	07

The responses for the drop-outs were less positive on every item than for the students who remained in MEGSSS (across items, an average of 34% of the drop-outs said MEGSSS "helped a lot", compared to 42% for those still in the program; and an average of 23% said it "did not help" compared to only 10% of those still in MEGSSS).

10. Please rate each of the materials listed below that you studied during the past year according to

a) how interesting it was to you and b) how difficult it was for you

1 = very interesting
2 = a little interesting
3 = not very interesting

1 = very difficult
2 = average difficulty
3 = not very difficult

Average Across 11 Topics	Interesting?			Difficult?		
	Very	A Little	Not Very	Very	Average	Not Very
Drop-outs	30	49	21	20	53	27

The drop-outs as a group found the materials less interesting than the group that continued in the program, but there was very little difference between the two groups in the perceived degree of difficulty of the materials.

11. Reason for dropping out of MEGSSS?

	Give as Either the First or Second Reason
Moved	05
Material was too difficult	12
Did not like the program	32
Required too much time	59

The principal reason for dropping out was that the program "required too much time". From the open-ended responses on the total questionnaire, the "required too much time" translated into "too much homework" for about some of the respondents, "did not like class after the end of the school day" for some and "too much travelling time" for some. About a third of the students dropped because they did not like the program.

13. If you had it to do over again, would you have entered the MEGSSS program?

By a substantial margin, 68% to 32%, students agree that they would have entered the MEGSSS program.

(Additional data analysis on drop-outs of MEGSSS is found in MEGSSS Evaluation Status Report, Herbert, CEMREL, February 1981.)

The drop out problem is interesting or significant for four main reasons:

1. The very high drop out rate presents a number of administrative logistical problems in providing cost efficient classes at the level beyond the second year.

2. The very high drop out rate might be viewed as an operationally negative evaluation of the program.

3. The drop out might view himself or herself as less able or less capable and/or might be inclined to avoid further learning opportunities in mathematics.

4. The drop out rate might be different for girls than for boys.

Relative to (1), the program must have a large enough participation in the initial nomination process to ensure a large enough pool of potential participants to guarantee that the initial group is large enough, considering the attrition rate, for a reasonably sized group to be still participating during the latter two or three years of high school. Our best guess is that an initial starting group of about 100 students would be the minimum required for MEGSSS. In order to have such a large group, at least 200 students would need to be involved in the testing

for the program. To get enough students nominated would, it appears to us, require an active public relations program extolling the merits of MEGSSS. The recruitment of students would depend upon the ability of MEGSSS to convince both students and parents that the program provides a valuable intellectual activity, superior in quality and not available in the existing secondary schools' curricula. A concerted community-at-large public relations campaign involving MEGSSS parents would be highly desirable. Endorsements from area universities and colleges as well as significant local industries or businesses would also be desirable.

However, such an approach is a true double-edged sword. On the one hand, it is desirable to increase the public interest in and awareness of MEGSSS to assure a sufficient student population to maintain the program, but it is also desirable to maintain or establish good working relationships with the local school districts. Positive relations with the local districts are obviously necessary to the involvement of students both while in MEGSSS and in the event the student chooses not to continue in MEGSSS. Herein lies the dilemma. How does MEGSSS interest students and parents in a "valuable intellectual activity superior in quality and which is not available in the existing secondary schools' curriculum" and not force the local districts into a defensive, non-cooperative, even resistive, stance toward MEGSSS?

The second point regarding the undesirability of a high drop-out rate, it seems to us, suggests an area for further investigation. The data presented here from the student questionnaires seem to suggest that students may not continue for many reasons other than lack of ability and that most of those reasons are extraneous to the MEGSSS classes and more to do with the logistics surrounding those classes.

However, a look at the open-ended responses on the student questionnaire reveals comments such as, "one reason some things are harder was that they weren't interesting. You couldn't pay attention for an hour and a half...," "some of the material was covered too fast.", "...teachers should take a little more time explaining.", "...sometimes boring, some teachers don't explain it well enough.", "...some classes barely held my attention.", "I would have liked to continue, but everything we went through the second year, we went through a little too fast for me.", "I liked the first year, but it got worse the second year because I couldn't keep up.", etc. We selected these comments because they were each representative of the remarks of several students. To us, this suggests that the materials utilized, the pace, and the teaching practices employed should be investigated. Changes might be made that would make the classes more interesting and less difficult. These are aspects of the program that the MEGSSS staff could control with relative ease, whereas some of the logistics extraneous to the actual classroom activities are more difficult to change.

Attrition should be expected. It is not enough, however, to just accept it. MEGSSS should constantly evaluate the classroom activities and materials to minimize their influence in causing students to drop out and to maximize their retentive value.

Regarding point 3, the potentially lowered self concept of drop-outs, the student response to questionnaire item 13 would tend to negate this assertion: most drop-outs would have chosen to "do it again". Also, our interviews with students and parents of students who had dropped out did not reveal that the students viewed themselves as less capable. Rather, all the students we did interview were involved in mathematics classes in their schools. This point, however, was one of the central points in the criticism of MEGSSS by both university/college educators and secondary

school math educators who were non-supportive of MEGSSS. Our view is that the assertion is probably unfounded, but is worth of further investigation in order to dispel it completely. A simple follow up of the drop-outs to determine what mathematics they have taken since dropping MEGSSS would serve this purpose.

In reference to point 4, the breakdown in enrollment and attrition by sex is shown below:

	1978		1979		1980		Combined	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Number who started	27	21	57	57	53	34	137	112
Number still in program	7	6	25	24	44	30	76	60
	(26%)	(29%)	(44%)	(42%)	(83%)	(88%)	(55%)	(54%)

(MEGSSS Evaluation Status Report, Herbert, CEMREL, February 1981)

It can be seen that the drop-out rate for boys and girls is remarkably similar. It can also be seen that more boys start the program than girls, particularly in 1980. This is perhaps an area of interest for further study. Why do more boys than girls enroll? What could/should be done to remedy that situation?

Students Still Participating in MEGSSS: The reviewer of this report might find it of interest to compare the responses to the end-of-the-year questionnaire given by students who chose to remain in the MEGSSS program. What follow are a few questions excerpted from the questionnaire of the 1979 group after one year in the program. (See the MEGSSS Evaluation Status Report, Herbert, CEMREL, February 1981 for a full discussion of the questionnaire results.) Questionnaire results had not been compiled for the questionnaires completed at the end of the 1981 year and were thus unavailable to the site evaluation team.

The end-of-the-year questionnaire was completed by 64 of the 71 students continuing in MEGSSS. The following questions allow some comparison by the reader with the data reported in the previous section on drop-outs:

5. Would you have preferred to have MEGSSS in your own school as part of your regular daily schedule, instead of 2 or 3 days a week at the MEGSSS Center?

Sixty-one percent would have preferred MEGSSS at their own school. Among students who could be identified as being from more distant school districts, such as Ferguson-Florissant, the percentage was barely higher, 63%.

6. Do you think your time in MEGSSS is helping you in the following ways?

	Helped a lot	Helped a little	Did not help
Reading with better understanding	(19)	(73)	(08)
Taking notes more efficiently	(28)	(52)	(20)
Organizing your thoughts better	(55)	(41)	(05)
Budgeting your time more usefully	(52)	(33)	(16)
Communicating more clearly (i.e., speaking and writing)	(17)	(64)	(19)
Learning how to think about mathematics	(83)	(16)	(02)

Not surprisingly, most students thought they were "helped a lot" in learning how to think about mathematics. Over half the students expressed a similar opinion for organizing their thoughts better and for budgeting their time more usefully.

7. What are the best things about MEGSSS?	(open ended)

The things listed most often are shown below in descending order of frequency. Since more than one thing could be mentioned by a student in this free response question, the percentages will add to more than 100.

Learning more, or at a faster rate, than regular school	(38)
Interesting/challenging	(22)
Social reasons/meeting people	(14)
Good teachers and teaching	(14)
College credit	(13)
Other	(22)
Future advantages	(06)

8. What are the worst things about MEGSSS?	(open ended)

Too much time (aside from homework)	(55)
Too much homework	(20)
Loss of after-school activities	(17)
Other	(17)

In some cases it was not clear whether "too much time" referred to transportation time to and from MEGSSS or to the actual after-school instructional time. In any case, "too much time" and "loss of after-school activities" can be combined so that almost three-quarters of the students mentioned some aspect of the time requirements of MEGSSS as a worst thing.

9. What suggestions do you have for improving MEGSSS?	(open ended)

Fewer assignments, tests	(29)
Better location	(24)
During regular school hours	(24)
Other	(22)

Several of the suggestions dealing with fewer assignments recommended longer assignments on the weekend and fewer during the week. All of the "other" suggestions were individual, given by only one student, and varied from "be able to work ahead" to "better snacks".

We were privileged to interview a substantial number of MEGSSS students, choosen at random from all four levels--first, second, third and fourth year. These students had a very positive attitude about the MEGSSS program. They also, in our judgement, had a very positive attitude toward learning in general. They were generally critical of their regular school offerings but were not hostile towards those offerings. They simply reported them to be of little challenge. One student remarked that "If it was not for MEGSSS my brain would be dead." Many others expressed a similar view, perhaps not quite so succinctly. It is worth noting that the older the student, the more likely they were to report that something about their regular school program was interesting or even challenging.

The younger students did report that peer pressure was a significant factor that affected them in their regular school. They frequently reported that others were jealous of them or resentful toward them. They also reported that some teachers seemed biased against them because they were involved in "that gifted math

program". However, they did feel that the stimulation of the MEGSSS classes and the opportunity to be with their intellectual peers out-weighed any negative reactions by their school peers or teachers. This problem was not apparent among the older students in that they appeared to posses a more lucid focus and direction for learning. One member of the fourth year class, speaking as a representative of the others in the class stated, "One of the really great things about this class is you can just be yourself. In our other classes, you have to be constantly on guard and real careful that you don't answer too many questions. You also have to judge how far you can go in challenging a teacher." Another said, "Yeah, if you're real smart and you know it, you don't have to have your classmates or your teacher upset at you, unless, of course, that is your goal."

We were most impressed by these students as we observed them participate in their MEGSSS classes. They were highly involved, showed understanding of the concepts taught, exhibited excellent listening skills toward teachers and fellow classmates, and engaged in discussion, disagreement, and argumentation in a very impressive non-competitive style. The classroom atmosphere will be addressed more fully in another section of this report.

The students, we judge, both through our observations of their behavior in class and through interviews, have a very positive but not, in our judgement, inflated self-image. One of the first year students stated, "It was a real shock to find a whole room full of kids who could do things as well as and as quick as I could. At first, I was a little worried or scared. Now I find it to be real exciting." The others in the group concurred.

One of the true strengths of the MEGSSS program is its intelligent, articulate, and highly motivated students. We believe it is a very positive evaluative comment to say that the program showcases this fact.

We were impressed with the student performance we observed in the MEGSSS classrooms, and we were particularly impressed with their discussion of a set of problems submitted to them by Dr. Ross--a collection of problems vastly different, in our judgement, from those they encounter in their study of the EM materials. Nevertheless, the question of student achievement looms as a very important one for a program like MEGSSS. (It is an important question for any program, but usually only those who choose to depart from the accepted norms are asked to justify that departure with achievement data.)

For various reasons, the evaluation of student achievement in a program like MEGSSS is very difficult.

- There are no adequate control groups (and merely selecting equally bright students as controls would not take into account the motivation involved in <u>choosing</u> to be in a program of this kind).

- There are no comparable programs in use in the St. Louis area. Since MEGSSS students come from 13 different school districts, the practical alternative to MEGSSS will vary considerably for different students. Traditionally the needs of such students have been met by either pulling together groups of students to work together on special short-term projects, including contests, or, more commonly, acceleration of curriculum. In this latter case, the amount of acceleration and point of entry may vary according to the ability of the students selected, and in the

best programs a student may complete, and receive Advanced Placement for, a calculus course. But in such cases the curriculum is very similar to the regular academic mathematics sequence (but done more quickly with additional content covered in the last year or two) and thus is quite different from the content of MEGSSS.

- There are no standardized tests available for the MEGSSS material, and few adequate, widely-used ones even for the standard algebra-geometry-algebra-trig sequence.

(MEGSSS Evaluation Status Report, Herbert, CEMREL, February 1981.)

Our view is that the fundamental question MEGSSS is forced to confront is whether or not students are missing any mathematics by being in MEGSSS. It is of course a most difficult question to address. For those who continue in the program, it cannot be fully answered until they have completed the program, if then. It might be partially answered for those who drop out, by determining the ease or difficulty they have in fitting into their school's regular (advanced) program. This is an area of stated concern of school personnel, particularly mathematics coordinators in participating and non-participating schools. Our view is that the concern is mostly administrative because these students can learn most material that they had not learned, if there is in fact anything they have not learned, quickly and with ease. They should have no difficulty in entering the advanced track at any point, provided they are allowed to do so.

The Cooperative Algebra Test, Part 1, was administered to the 1978 and 1979 groups of students when they were eight graders nearing the end of their second

year in MEGSSS. This test is part of the Cooperative Mathematics Tests, published by Education Testing Service. According to the test manual, this test corresponds approximately to the course frequently termed "elementary" algebra and the appropriate target group is eighth and ninth graders.

Cooperative Algebra Results

Raw Score	Number of Students 1978 group	1979 group	Mid Percentile Rank Suburban 8th	National 9th
37-40	8	7	94-99	99
34-37	7	3	74-89	96-99
31-33	4	9	43-74	89-96
28-30	1	12	29-43	79-89
25-27	1	4	14-29	66-79
23-24	0	1	< 14	60
N	21	36		
$\bar{X}$	34.8	31.5		

The MEGSSS students almost all scored in the upper quartile of the national group. Compared to the more selective suburban group, over 70% of the 1978 group scored in the upper quartile, and over 25% of the 1979 group scored in the upper quartile.

To answer the question raised, the comparison to the suburban group is probably more significant since the suburban group is presumably accelerated and pointing toward calculus in grade twelve. The students in MEGSSS would most likely be in the fast track were they enrolled for mathematics in their home district/school.

The data presented here does not give a conclusive answer to the question. Further investigation is warranted. We would suggest that a test of geometry also be given after the third or fourth year in the program since geometry is a normal course in the advanced sequence of the Metropolitan St. Louis districts, offered either in grade nine or grade ten. Furthermore, we believe, the data collected by the administration of such instruments must be viewed along with an examination of the EM materials to which MEGSSS students are exposed but that are not part of the traditional accelerated curriculum. In short, the comparisons are unfair if only one-directional.

Parents and MEGSSS: At the end of each school year a brief, open-ended questionnaire was sent to the parents of all MEGSSS students still in the program and intending to continue in the fall. A second questionnaire was sent a month later if no response was received. Either at the end of the school year, or about a month after withdrawal, an identical questionnaire was sent to the parents of all students who were intending to, or had, dropped out of MEGSSS. A follow-up questionnaire was also sent if the first one was not received.

The questionnaire was entirely open-ended and asked for best aspects, worst aspects, suggestions for improvement (organization/management/staffing and reporting/communication), and overall evaluation. Responses were classified in three ways: overall evaluation, positive aspects of MEGSSS and negative aspects of MEGSSS.

The questionnaires from the spring of 1980 were collected and summarized. A total of 42 of the 71 (59%) questionnaires sent those planning to remain in MEGSSS were returned. Twenty-eight of the 65 (45%) questionnaires sent to those who had dropped or planned to drop were returned. The following summarizes the feedback according to whether it was from parents of continuing students or of drop-out students.

1. Overall Evaluation: Based on a reading of the entire questionnaire, an overall evaluation was subjectively inferred and categorized in one of three ways shown below (the numbers shown are percentages).

	Continuing	Drop-out
Adequate at best, with many or major misgivings	05	16
Good, with few or minor misgivings	51	44
Excellent	44	40

There is surprising little difference between the two groups of parents in their overall evaluation of the program. Parents of drop-outs were more likely to give negative, or very qualified praise of the program, but the percentage (16) was still quite low.

2. Positive Aspects. The percentage of questionnaires in which, somewhere, a given positive feature of the program was identified by the parent is given below for the most commonly noted features. Percentages may add to more than 100 because of multiple responses.

	Continuing	Drop-out
Challenging	57	59
Good material or content	26	11
Promotes good habits (study, discipline, neatness)	24	22
Cognitive growth (creativity, problem solving, etc.)	24	07
Social gains	24	07
Good teaching	19	19
Good experience in general	09	07

Easily the most positive aspect of the program for the parents is that MEGSSS is challenging for their students. The differences between the two groups of parents was that parents of drop-outs mentioned materials, cognitive growth, and social gains much less often than did the other parents.

3. Negative Aspects. The percentages noting the most common negative features of MEGSSS are shown below.

	Continuing	Drop-out
Too much traveling time/bad location	57	54
After school hours/loss of social, activities time	55	68
Parent/teacher communication problem	21	07
Too much work/pressure	17	32
Disagreement with content	14	07
Too expensive	12	11
Student/teacher communication problem	10	25
Conflicts with school time	07	00

The first two items, themselves strongly related, are clearly the dominant negative feature of MEGSSS to the parents. Almost 80% of them listed at least one of these aspects of too much time.

On the matter of communications, a question asked specifically on the questionnaire, it was the case for both groups that about a third of the parents noted a problem (or made suggestions), a third said the communication was adequate or, more often, excellent and the other third did not say anything (and by inference, did not have complaints in that area). Of those who did mention a problem, or made a suggestion, about 2/3 of the continuing parents were concerned with parent/teacher communication (versus 1/3 with student/teacher) whereas the proportions for parents of drop-out students were reversed.

Otherwise, the responses were similar, the largest difference being that parents of drop-out students were twice as likely to mention that there was too much work or pressure.

In comparing positive and negative features noted, continuing parents mentioned about as many positive as negative aspects, an average of 1.8 versus 1.9. (It should be noted that part of the questionnaire was an attempt to elicit suggestions for improvement, all of which were treated as negative aspects for the purpose of this analysis. Therefore one should not interpret these statistics to mean that the balance was about equal between positive and negative evaluations of MEGSSS; as the data in 1., above, suggest, the overall evaluation was clearly positive for most parents.)

In comparing positive and negative features noted by parents of drop-outs, there were about 50% more negative features (an average 1.3 versus 2.0). Therefore, one difference between the two groups may be that parents of drop-outs saw fewer positive features than did continuing parents (but not really more negative features).
(MEGSSS Evaluation Status Report, Herbert, CEMREL, February, 1981)

The questionnaires returned in the Spring of 1981 had not yet been compiled and thus a summary of data was not available to the site evaluation team. However, from our reading of those questionnaires, we did not detect any obvious shifts in parent opinion regarding MEGSSS. We choose to include here some excerpts from this more recent set of questionnaires to give the reader of this report a flavor of parental opinion.

From the questionnaires returned by parents of drop-outs, the following are some representative responses:

To the best aspects of MEGSSS:

- "...challenge to students commensurate with their abilities; sympathetic and helpful teachers; opportunities to work with students of like abilities."
- "...teaches students how to work hard; teaches value of constant commitment of time and effort; better intellectual challenge than regular school work."
- "...excellent math program--a challenge for good students."

To the worst aspects of MEGSSS:

- "...amount of time needed curtails other activities at a time when students need to explore a number of academic and social areas; occasional transportation problems..."
- "...requires constant commitment of time and effort that occasionally interferes with other valuable opportunities."
- "...time (of the day) the classes were taught."

To overall evaluation of MEGSSS:

- "I think MEGSSS could evolve into an excellent area—wide program... An independent governing board is needed to work out details regarding location of teaching centers, staff, transportation, and other administrative details. I feel that the program itself fulfills a need in education--to provide wider and more challenging experiences for the area's gifted children."
- "Super! We are deeply grateful that our daughter had the opportunity for MEGSSS and wish that she would continue!"
- "This questionnaire does not ask why we are taking ____ out of the program. There has been a lack of concern as to why students drop the program. I hope this improves in the future."
- "...it was hard for my son in that he is in parochial school and he had to give up some of his English classes to get there on time. Our school was not geared to letting students out for extra classes. It also prevented him from participating in some basic activities of the school. Advanced English classes and Science classes were held after school also. We feel our son needs more overall schooling at this time and so we are discontinuing the program next year. It took us 35 to 45 minutes to go each way. Many times my son came

home with a headache from the drive. We feel sattelite classrooms would help an awful lot."

- "...the program provides a challenge to the "good" math student. Some cause of concern is that there seems to be subject matter which is covered in the regular classroom which has not been covered in MEGSSS. Will the student fit into the regular classroom and at what level?"

- "MEGSSS is a program which makes heavy demands on very young students. While I can see the importance of stressing math I feel it deprives kids from developing as a total individual...I guess if a kid is going to be solely a mathematician, MEGSSS is the best thing for him. But there is more than just math. I believe students who leave MEGSSS will continue with math and some will become teachers in programs such as this. I just don't think it's necessary to rush a sixth-seventh or eighth grader through a concentrated math program at the expense of the rest of their growing years. The baseball game missed is gone forever; math can be pursued now, at 18 or 48."

- "I feel the MEGSSS program is a golden opportunity for the gifted student and am happy ____ was able to complete at least one year in the course--would love to see him continue...it provides a challenge that is needed. I saw this enthusiasm in my own son and it did not wane until late spring. It came as a surprise that he did not wish to continue. We can only wish the program success."

- "I'm very grateful for the MEGSSS program and the 2 years of intensified math study ____ took. Since this is her last year, we are discovering the counselors and math teachers do not know for sure where she'll fit in to the high school math program. Somehow, there should be a way to overcome this problem. We've run into this with all the programs for gifted in our area."

- "I feel this has been a good experience for ____. Unfortunately ____ did not care for the MEGSSS program. He could not see how this could possibly help him. I tried to explain that maybe in high school or college he would draw upon his experience in this course. ____ did enjoy the summer classes with the calculators very much."

- "...he was excited by something new to learn. It was the one real stimulating thing in his day. He worked happily at home but now this year he's working on old algebra and he doesn't want to go to regular classes."

From the questionnaires returned by parents of continuing students, the following are some representative responses:

To the best aspects of MEGSSS:

- "Association with good, well-motivated students. Learning real math from highly interested teachers. Association and participation in excellence."
- "____ is with other bright kids, she is challenged, is treated like an adult, learns the value of solid work. Some of the materials are very good."
- "The development of more advanced thought processes in the children; improved study habits necessary to succeed in the program; the breadth of mathematics material surveyed."
- "Increased self-confidence for child. Forces student to do mental work. Provides challenge missing from normal school work..."
- "The quality of the mathematics offered and the dedication of the teachers to allow these youngsters to achieve their highest abilities."

To the worst aspects of MEGSSS:

- "A high attrition rate."
- "Car-pooling. My personal opinion is that certain parts of the materials are ill- conceived and overly didactic. Too much formal logic and not enough mainstream mathematics and problem solving... Much of the program comes across as "super new-math".
  The program is good because the students are good. With this bunch any material will produce outstanding results.
  The attrition rate is too high. These are very bright children, and it is a sin to send them away feeling stupid."
- "After-school scheduling/distance traveled--time involved for parents/children. A 10 hour day is too much for 12-14 year olds... precludes other after school activities. Also, problems with re-entry into regular math curriculum at home school were somewhat minimized at the interviews, whereas the problems are actually substantial."
- "Almost by definition, choices have to be made between participation in MEGSSS and other worthwhile activities."
- "Outside normal school hours; transportation to/from is a BIG problem..."

To your overall evaluation of MEGSSS:

- "Excellent opportunity for our daughter. The math content is impressive; explanations (texts) are extremely well-written; and quality of the teaching is superb! I feel MEGSSS is the best educational find for this child ever!"

- "MEGSSS is a splendid program conceptually and greatly needed by the community of bright children. I do feel that it moves too fast at times. As I have indicated, its greatest drawback seems to be the time commitment for classes, which is excessive for young teens/pre-teens and causes the most complaints from the kids I've been listening to all year in our carpool."

- "The idea of bringing gifted children together is very good, though I do not believe these materials and methods are the only way to do it; nevertheless, I am grateful that the program is in place."

- "We are very pleased with the program; it offers the secondary school student an opportunity to gain a much broader exposure to Mathematics than is available in the conventional school curriculum, and therefore builds interests that might otherwise not be stimulated until much later, or which might be suppressed completely. Mathematics is an immensely interesting and valuable subject, and there is no reason to make it boring by restricting the fun."

- "MEGSSS has been the high point of _____'s education and he and his parents both hope for its continuance. Mr. Fitzgerald and Mr. Kaufman have been good with us in many ways. The parents and board have been problems but things now seem as good as funding allows."

- "We are happy that our child can be challenged, <u>finally</u>, in his school's education."

- "Overall very pleased; has met and satisfied an intellectual need of gifted students (for math and otherwise) provides a stimulating environment for exchange of ideas and fun among students (peers) and faculty."

- "It is the single best educational experience my daughter has ever had."

In our judgement, parents of students who are participating or who have participated in MEGSSS are supportive of the program. They are overwhelmingly thankful that such a program for bright students even exists. They demonstrate their genuine concern by arranging transportation for their children and offering

encouragement. Those presently participating are also paying a substantial tuition fee ($300.00).

Many parents do raise concerns over the work load imposed on young children, over the time demands of the classes and traveling to/from the classes, over the necessity to eliminate other valuable activities in favor of MEGSSS, and, for some, over the actual content presented in MEGSSS. They generally counter these concerns with their pleasure over the good study habits instilled in their children, the challenge of the program, the excellent teachers and, most often cited, the opportunity of their children to work with/interact with gifted peers.

We find that these pleasures are quite understandably attributed to MEGSSS because of the apparent lack of other "gifted program" activities available to these youngsters. That is not to imply that we believe these are not true outcomes of MEGSSS, but we do feel that one should accept the "positives" in that light and look very closely at the "negatives". The "positives" should not be thought of as cancelling out the "negatives" but rather strengths to build upon as MEGSSS tackles the problems perceived by the parents and the students.

The students we interviewed said that their parents were generally pleased that they were nominated for MEGSSS but that the parents had allowed them to decide whether or not to participate. Not one student in the program presently said that they were there because that is what their parents wanted. On the other hand, of the students who dropped out that we interviewed, at least half said they probably took the program because their parents wanted them to try it. It is also interesting that several of the parents of drop-outs indicated on their questionnaire that they wished their child were continuing.

Students with whom we talked indicated that the idea of getting college credit for MEGSSS classes generally appealed more to their parents than to them.

The MEGSSS Board members, parents of children in the program, impressed us as a genuinely concerned, dedicated group. Their commitment to the program was obvious. A Board of this type is, in our view, most important to a program like MEGSSS. However, it is unrealistic to expect these Board members, individually or collectively, to administer the program and/or to serve as the financial facilitators and fund raisers.

The Educational Community and MEGSSS: The educational community of the metropolitan St. Louis area could be characterized as not supportive of MEGSSS. Easily the least supportive members of this group were the mathematics personnel in the home schools. Their reactions to MEGSSS seemed related very closely to their reactions to the EM materials. That reaction ranged from "the materials are totally inappropriate" to the "materials are worthwhile mathematically, but overly ambitious." These mathematics educators were unconvincing, to the site evaluation team, regarding their claim to have studied the EM materials. One district level mathematics coordinator who was supportive of the program had been much involved with the U.I.C.S.M. materials in the 1960s and had studied the EM materials also. The others had visited MEGSSS on several occasions.

It generally seemed to us that the home school mathematics coordinators were key individuals in the view of the home school regarding MEGSSS. Those districts, particularly the larger non-participating districts, seemed to take the stance they did regarding MEGSSS because of the recommendations of these math coordinators.

The math coordinators were generally pleased with their district's fast track program. That program was usually Pre-Algebra in Grade 7, Algebra in Grade 8, Geometry in Grade 9, Advanced Algebra in Grade 10, Trigonometry and Pre-Calculus in Grade 11 and Calculus in Grade 12. They felt that they had excellent math teachers on their staff--particularly on the high school level. These coordinators were inclined to admit that the junior high school program was the weakest link in their sequence, both mathematically and in provisions for the gifted child. Even so, they were not inclined to suggest that MEGSSS might be a good alternative for a gifted student during the junior high school years. They cited the problems of integrating that student back into their regular fast track sequence as prohibitive.

The mathematics personnel had no vested interest in MEGSSS but did seem threatened by it. They claimed either to see no need for any special program other than what was provided by their district for the really bright or they said their program would suffer if all the bright kids were funneled off to participate in a program such as MEGSSS. One MEGSSS parent from a non-participating district addressed both points eloquently in a letter to the district's Board of Education. He wrote,

> "...as to whether the MEGSSS program is the "best" one for the "top five percent" of the school population, it is not at all apparent to me how one might clearly define "best", or "top five percent", or what the point of doing so would be anyway. To begin with, almost nothing is ever really the "best possible"; virtually anything can be improved. More fundamentally, the very notion of a "best program for the top five percent" bespeaks a presumption of homogeneity within that group--that is, that the same program could in some sense be optimal for the entire group. Clearly, that is rather unlikely. As far as I am concerned, no one has claimed, or could claim, that either the MEGSSS program, the ____ program, or any other program is "best" for any "top five percent", whatever those terms might mean. One person's meat is, after all, someone else's poison; the thing to do, it seems to me, is to keep alternatives open, and not to try to jam everyone through the same pipeline. ...one point that needs to be made is that the

MEGSSS program really should not be viewed as a threat to the integrity and significance of ____'s own in-house program for gifted/talented students in mathematics. An area-wide "clinic" of this sort can necessarily only accommodate a small number of students from any one school. I believe there simply would not be any major "brain drain" from ____ or anywhere else.

Even among the very best students, there will be many who are, for a variety of reasons, unable or disinclined to commit themselves to such a rigourous study of mathematics. Many students may have the aptitude but perhaps have equal or even stronger interests in other areas, and may prefer to spread their energies more evenly over several fields. For some families, the problems of time and transportation may be prohibitive factors. Some top students simply may not develop very strong interests in mathematics until after the point in time at which they would have been able to get on board the MEGSSS program. And of course students may transfer into this area from elsewhere at a later point in time than that at which they would have been able to get on board, even had they been so inclined.

The great majority of students would in any case continue to be served by the present program, and enrollment of a few students in MEGSSS would in no way diminish the need to maintain the strongest possible in-house program. Indeed, it could perhaps be argued that one positive side-effect of participating in MEGSSS would be to open up a few additional slots to accommodate students who might otherwise not be reached by the district's own efforts for the gifted."

After talking with the mathematics coordinators of the larger districts, we concur that this parent makes an excellent argument.

The other home school personnel generally appeared to have little or no information about MEGSSS. Students reported that the school counselors and teachers knew little or nothing of the program and could not help them. The area of career counseling is of particular concern since these students represent the life-line of our country.

Administrators from the participating districts ranged from mildly enthusiastic to tolerant toward MEGSSS.

Generally, they felt that MEGSSS had the potential to offer something to very bright students that their district might not offer because of the small number of eligible students in the district. Also, they generally supported the idea that "alternatives" should be available to the parents and students.

The mathematics departments of the local universities and colleges appear to be little involved with or unfavorable toward MEGSSS. The chairman of the department at the University of Missouri at St. Louis was reported, by his wife, to be very negative toward the EM materials. Both he and his wife had been involved with the North County break-away group. She is presently teaching the GEM Class (formerly MEGSSS) at Webster College. The Webster College staff members who had taught the MEGSSS class there were also generally negative toward the EM materials although supportive of a program for the gifted. It is our view that the mathematics community of the other universities, colleges or junior colleges in the area are uninvolved, if not, uninformed.

It is our view that the attitude of the educational community is critical to the success of a program such as MEGSSS. It is apparent that, for whatever reason, the MEGSSS program has not done an adequate job of informing and involving the educational community. MEGSSS at first had a steering committee made up of a contact person from each of the area participating schools. This group was used early as the contact with the local districts, but was apparently never really involved in program policy matters. It apparently no longer exists. We could not determine that there were any conscious efforts to involve math educators from the college community. (A CEMREL staff member indicated that there was a conscious effort <u>not</u> to approach all the area colleges but to develop a special relationship with one of them, Webster College.)

Teachers and MEGSSS Classes: Our initial reaction to the MEGSSS classes was that they resemble a typical college lecture session. The teacher dominated the instructional time utilizing the text to work a series of exercises. However, as we gained a more comprehensive perspective of all the MEGSSS classes, our viewpoint moderated somewhat. The classes do tend toward the "traditional". The teacher is the dominant feature. The percentage of class time that was teacher talk averaged about 70% during our observations to about 30% student talk. Most of the student talk was focused in explaining a solution to a problem or in direct response to a question from the teacher. The student responses to these questions were usually volunteer, but not spontaneous. The classrooms were controlled. Students usually were called upon to respond and it was unusual for a student to respond to another student directly. The classes we observed working with Book 0 material tended to depart significantly from the formal college lecture style to a more inductive approach.

In all the classes, students were highly involved and attentive. This is truly an outstanding feature in a class of 33 seventh grade age students meeting between 3:00 and 5:00 p.m. The students were involved in a group interaction (even though controlled, the ability of the students to listen to the presentation of another student was impressive) and in a thought-provoking inquiry approach.

The student classroom demeanor of the third, and particularly the fourth year class was very interesting. The dynamics of the easy give-and-take between students and the obvious mutual respect for each other was most notable.

In short, in the classes observed, student interest was strong. The students were eager to participate in the learning activities that were provided. The

students were highly articulate in describing solutions in precise mathematical terms. It appeared obvious that the students had developed good work and study habits. The problem solving skills of the students were reflected in the novel and unique approaches to the problems presented by Dr. Ross. It was apparent that some of the MEGSSS students can apply the mathematics they have learned to situations with which they are not familiar. Regardless of one's perspective on proper content, these students are doing some high-powered mathematics and doing it very well.

In a teacher-dominated program such as we observed at MEGSSS, obviously the teacher is very, very important. The following is a brief summary of our impressions of the three MEGSSS teachers we observed:

- Jim Harpel is a highly competent instructor of mathematics. His questioning technique solicited good student response and he was able to arouse good student interest. He used student's ideas and offered praise and encouragement. He consistently attempted to facilitate student exchange with comments like, "Do you buy that?", "Any other ideas?", "Can you think of any examples?", "Is that OK with you?" Students respond to him in a positive manner in class. He has good rapport with the students.

- Jack Fitzgerald is an excellent instructor of mathematics. He exhibited a solid understanding of his students and the materials. He utilizes a superior questioning technique that challenges the critical thinking of his students. He exudes an enthusiasm that is contagious in the classroom. He is masterful in handling the incorrect student response to generate additional discussion in the class. He was the best of the three teachers at employing an inductive, discovery teaching style. He obviously has an excellent rapport with his students. We were

extremely impressed with Jack's orchestration of a class.

- Burt Kaufman is a dominant, dynamic teacher. He is a high quality instructor with a tremendous familiarity with the materials and the mathematics to be presented. There was a significant emphasis in his classes on proof with precise language and notation. He uses a teaching style that is highly challenging, but not rejecting, of the learner. He brings a diversified background that enables him to relate the subject to other mathematical and non-mathematical fields. When we observed Burt, he was serving only as a substitute teacher for Harpel and Fitzgerald. He was most impressive in handling the discussion of the problems supplied by Dr. Ross.

A review of the data collected from parents will show that the parents have a very high regard, rightfully so, of the teachers and the teaching in the MEGSSS program.

The students generally give a positive evaluation to the teachers. The following are some student comments that give a flavor of their collective view of the teachers:

- "...teachers should teach better."
- "Mr. Kaufman is not a good teacher...he is too smart for the students to understand him."
- "Mr. Fitzgerald is an excellent teacher."
- "The best thing about MEGSSS is the teachers."
- "...things not understood are always explained..."
- "...teachers should work slower on the harder stuff."
- "...MEGSSS teachers are real nice, they really care about you in a sort of personal way."

- "Fitz really makes you think."
- "All the teachers are real smart, but they let you try out your ideas."
- "I think the teachers are very fair."

The MEGSSS or EM view is that "the mathematical mode of thought is one of the most powerful and elegant ways available for organizing our experiences and our ideas." Students should be "given opportunities to follow, invent, and report mathematical arguments; to develop creativity and freedom in the use of language within the bounds imposed by a very rigorous and demanding discipline; and to experience nontrivial, relevant applications of mathematics through mathematical modeling." (MEGSSS In Action by Kaufman, Fitzgerald, Harpel, CEMREL, Inc. 1981) The MEGSSS classes are an operational testimonial to the accomplishment of that aim. The classes, particularly the third and fourth year, are a collection of practicing, developing scholars. The success of this program, in our view, rests squarely on the shoulders of the teachers. We applaud them for what they have accomplished to date.

RECOMMENDATIONS AND REPLICABILITY

In recent years, there has been a growing interest in and concern for programs for the gifted and talented. Most of the attempts to provide specialized opportunities for children identified as gifted and talented tend to be what we would call "elective" in nature, "holistic" in concept, and most often do not use any specific content prepared specifically for the gifted. Even the best of these programs usually do not provide for the highly gifted in a particular content area. If for no other reason, we find the MEGSSS concept interesting and potentially fruitful. As one parent commented, "The program is the only American response we know of which spans public, private, and parochial education as well as numerous school districts." Another commented that "Many of us who believe in the public schools, and who want our children to remain there, are concerned with our perception of diminished opportunity for the above average student. Clearly, numbers of parents are turning to private schools in an attempt to answer their needs. I believe this is turning into a vicious cycle, as many of the better students are leaving the public schools, thus further lowering the overall expectations within a school system."

This concern was echoed by a St. Louis area local public school superintendent who has evidence that as his district schools have become integrated, parents have come to perceive--rightly or wrongly--that there is a lowering of educational sights as the need to develop special programs for low achievers becomes more prevalent. He feels that he and the superintendents in all the other metropolitan districts must maintain a balance in their programs--that they must deepen their concern for programs for the talented and the gifted just as they must develop special programs for those who need additional special help to achieve better. He feels that only in this way can the school district respond

adequately to the need to be flexible in its responsibility to all its children, and that such a flexibility of response will help maintain the morale of the staff and students. as well as help to meet the variety of parental expectations he faces. He is strongly supportive of MEGSSS for this reason, for without it his district could not afford to initiate or maintain a similar program.

As another parent succinctly put it, "The model provided by Project MEGSSS could eventually be utilized by centers everywhere to more economically provide specialized education to the gifted. Most school districts are experiencing financial difficulties and have no funds to concentrate on a minority of students. However, if costs were shared by many school districts, as the case would be if this model is proven successful, this special education could be made available to all."

We share these views of the potential of a MEGSSS type operation and we do believe it is a feasible model for other areas of the country and also for other areas of the curriculum besides mathematics.

Sadly, we realize that the most immediate concern for MEGSSS in St. Louis is survival. Survival is almost totally related to the ability of the present MEGSSS program to find funding to maintain its current level of operation. According to one MEGSSS Board Member, "the $300.00 tuition is the upper limit that we feel we can ask the parents to pay." But, according to a MEGSSS staff member, "a charge of $500.00 per student will be needed to continue the program next year." One can easily see why all of the energies of the MEGSSS people are directed to finding money to allow the program to continue.

In this section of the report, we will make recommendations that we feel would strengthen a MEGSSS type program and we will address some issues other groups should consider in attempting to replicate MEGSSS. These might also be recommendations that a financially solvent St. Louis area MEGSSS program would wish to consider.

Teacher Training

In order to utilize the Elements of Mathematics (EM) materials as the curriculum base for an instructional program like MEGSSS, outstanding teachers must be recruited and trained. Securing teachers capable of skillfully teaching the EM materials is, in our view, a large task. It is an extremely important issue in replicating MEGSSS and is a critical issue in the survival of the St. Louis area MEGSSS program. Regardless of how one judges the merits or shortcomings of the EM materials (see earlier section of this report), it is obvious that a successful teacher of the materials will need a very solid background in mathematics. In our judgment, a minimum of a Masters degree in Mathematics would be a prerequisite for someone to be considered trainable as a teacher of the upper levels, beyond Book 0, Chapter 10 and Book 1, of the EM materials.

This view of the special nature of the teacher required for the EM materials was supported by a number of persons interviewed by the site evaluation team. One University professor stated that,"High school math teachers are not well enough trained to handle even the early books of EM." Another stated that "Even the best of the Webster College MAT (Masters of Arts in Teaching) Mathematics people could not fully understand the materials--they could work the problems, but could not interrelate the ideas." A public school district Mathematics Coordinator said, "My teachers would need a lot of in-service to teach the EM program--they are good teachers, too."

In addition to the requisite course work in mathematics, teachers must have a flexibility in style to enable students to visualize the creative use of mathematics. Actively involving students in learning through thought provoking inquiry and skilled use of the inductive technique are two essential components of teaching

style in delivering this program to this type of student. Thus, the teacher must be exceptionally skilled and knowledgeable in mathematics plus very skilled and knowledgeable in teaching strategies. The nature of the student complicates the problem. A teacher of gifted math students summed this up quite nicely in her statement that, "these are very bright students; their minds are so receptive; however, due to their age, there are some with short attention spans." (The students observed in the MEGSSS classes did not seem to have short attention spans, even in the very large first year classes.)

We believe that the ideal teacher training program would be one that starts with teachers trained as required in mathematics and would involve them in the following:

1) Familiarization with the content and philosophy of EM,
2) Background information on the nature of gifted and talented students, with emphasis on the junior high school age group,
3) Training in teaching strategies,
4) Visitation to EM classes, and,
5) Internship instruction of an EM class.
6) Observation of other intensive programs for the gifted.

We are not aware of an existing easily accessible vehicle where this training could be provided. The inability to find suitably trained teachers may be the big drawback to implementing the EM curriculum, particularly beyond Book 1 and Book 0, Chapter 10. If another curriculum were to be chosen for a MEGSSS-type operation, we believe in-service in areas 2 and 3 above would still be critical.

Local School Districts and Local University Involvement

As noted earlier in this report, we feel that this is a very weak area for the St. Louis MEGSSS program. We feel that the support, the active support, of the local school districts and the local university community is critical to the success of a MEGSSS-type operation. If the program is to operate financially independent of the local districts, it is imperative that good communication and coordination exist between the program and the schools. This is important in obtaining students to participate; in facilitating the participation of the students by arranging schedules, recording credits, etc.; and in providing for the re-integration of the students back into the home school. The latter point, we see as particularly critical since most students do not complete the full six years. We believe that a "steering committee" comprised of representatives from the home schools should be formed and maintained. This group should be an active liaison group between the program and the home schools. It should also be used as an advisory group to the parent board regarding general program considerations. If the home schools are organized similarly to those in the St. Louis area, the district mathematics coordinators would be prime people to persuade to serve in this capacity.

A technical panel could be formed from the area universities. This group would assist the program staff in determining the broad curriculum of the program. The involvement of this group could be important in gaining the option of college credit for the students and could certainly assist in an important way in fund raising. This group could be important to the teacher training component mentioned in the previous section. Also, these persons could be enlisted as "guest teachers" for special topics to be presented in the program.

We believe that the best way such a program as MEGSSS can generate a broad base of support is through involvement. We strongly recommend the formation of a parent board, a school steering committee, and a university personnel technical panel. These three groups would provide an excellent start for developing the needed support base. The technical panel could also include key industry/business persons if fund raising from the sector were to be a hope of the program.

If the MEGSSS type program is to attempt to receive funding, at least in part, through the local school agencies, the need for the support base from that constituency is also critical. We do feel that financial support through or from the home school should be vigorously pursued. It would seem clear that the cost of such an operation, if MEGSSS is representative, is too much to ask parents to assume entirely. However, financial support might be available through state gifted and talented funds or from local district monies, if the district saw it as their obligation to provide programs for the highly gifted. In any of these cases, the local district would be involved in some way in the funding.

The type of vehicle involving the local schools that might be employed to sponsor and fund the program will vary from place to place. One former MEGSSS parent expressed a fairly definite view when asked if MEGSSS could work if the school district ran it. She said that "...an umbrella sponsorship involving several districts would be best. I have reservations about our regular school district because I'm afraid they would water it down." When asked to elaborate, she replied that "administrators and teachers would water it down. It (the program) would get bogged down. they'd count how many girls they needed and how many minority students... and it would get bogged down in how it looks to the federal government." Others

expressed the concern that if one district assumed the sponsorship of the program, other districts might not participate because of political reasons or simple jealousy.

Student Selection and Funding

A program such as MEGSSS will be expensive. The great bulk of the costs are personnel. Teachers needed to teach such a program are the "cream of the crop". It would be unrealistic to expect them to work for less than top wages. Further, we feel that such a program needs at least a part-time administrator. This position is vitally needed to perform basic functions of the program such as:

1) Recruitment of students,
2) Liason with home schools,
3) Contact with parent board, technical panel and steering committee,
4) Public and community relations,
5) Fund raising,
6) Counseling of students and parents, and
7) Other needed services.

It is unrealistic to expect these functions to be provided by the program teachers or by volunteers such as the parent board members. It may also be the case that a person who is an excellent teacher in the program might not have the skills or inclination needed for the administrative function.

It is hoped that the funding (cost) issue will not be a de facto selection criterion. It may already be the case for MEGSSS. One of the MEGSSS teachers stated that, "These kids essentially come from other than the city of St. Louis and are very wealthy." The privileged (monied) class does not have a lock on talent. However, if some mechanism for financial aid is not in place for such a program, the reworking of the selection criteria to identify a broader cross section of eligible students, including more minority children, will probably do little to change the make-up of the participating group.

Program Logistics and Attrition

In attempting to replicate MEGSSS, careful attention should be paid to ways in which attrition could be reduced. From the data available, the most significant causes of the attrition in the first two years seem to be logistical factors--particularly time involved and location. We feel, in a geographic area like St. Louis, it would be fruitful to establish classroom centers in more than one location. We are fully aware that doing so reduces the curriculum control. That is, students from different centers might cover some different materials and at different rates. That can present problems when the students are combined in a single class for the more advanced studies. However, that problem is far less serious than not having a sufficient number of students to warrant offering a class at the higher levels of the program.

Communication between the centers is crucial. The communications should stress comparable standards of excellence rather than doctrinal detail in following the curriculum.

Curriculum Alternatives

To reiterate, we do find the EM materials to be appropriate for gifted and talented students. We believe there does not exist another multi-year curriculum program that is as demanding for the gifted and talented students. We believe, even with the shortcomings cited earlier in this report, that the EM materials as a total curriculum for a six year program is superior to any other curriculum that exists. We believe that EM materials can be varied and augmented in a variety of ways that will maintain the integrity of the materials and allow for the individual tastes of the program implementors. However, because of the many problems alluded to in this report not the least of which is finding qualified teachers and organizing the program to assure a cost effective class size at the upper levels, it may be necessary, or even desirable, to investigate alternative curricula.

If the need for the alternative is primarily monetary, as appears to be the case with the St. Louis MEGSSS, a possible alternative is to operate the program as a three year program covering grades seven, eight and nine. The three year program could encompass a study of all or parts of Books 0, I, II, III, V, VI. A brief treatment of basic Eucleadian Geometry should also be included. The student, at the end of the three years, would return to the home school and participate in the advanced placement sequence of mathematics courses. In fact, it may be quite desirable to incorporate a MEGSSS-type program with the home school's advanced placement sequence of mathematics courses. (We do think that A.P. sequence should be studied for the purpose of upgrading the mathematics taught.) Due to many factors discussed in this report--funding, teacher availability, logistics, etc., the best possible course may be a three year program starting with grade seven

with students returning to the home school after grade nine. This would at least address what we and others perceive as the area of most need--the junior high school years.

If the need for a curricular alternative is primarily because of a lack of qualified teachers capable of teaching the EM materials, a highly likely situation, an alternative that relies much less on the EM materials should be investigated. The following is one curricular modification that might be appropriate:

Grade	Description of Program
7	Developing an intuitive background and informal argumentation utilizing primarily the EM Book 0 materials. The study of operational systems, the integers, sets, subsets, and operations with sets, ordered n-tuples, mappings, the rational numbers, decimals and applications of the rational numbers, introduction to probability, introduction to number theory, and algebra in operational systems.
8	Developing algebra and basic programming skills utilizing a high level algebra text. Algebra skills should include the following topics: sets of numbers, open sentences in one variable, systems of linear open sentences polynomials and factoring, rational numbers and expressions, relations and functions, irrational numbers and quadratic equations, complex numbers, binomial expansion, and matrices and determinants. These skills could be related to EM Book 0--Chapters 10-11. An introduction to computer programing emphasizing a process of iterative algorithms could be accomplished by using EM Book 0--Chapter 16.
9	Developing the logical machinery required in deductive organization of proof. Utilizing a high powered geometry text such as Moise and Downs. Euclidean, non-euclidean, and inversive geometry should be studied in conjunction with EM Book0--Chapters 12-13 and Book 1.
10-12	Advanced placement mathematics consisting of: trigonometry, analytic geometry, calculus, linear algebra, and differential equations.

We do not submit these as the only alternatives, but we do feel these are feasible ones. The first might be particularly operational for MEGSSS if MEGSSS is forced to curtail the operation to only three years. Both alternatives should provide for the relatively easy transition between the mathematics of the MEGSSS-type

program and the mathematics of the home school at the end of the third year. That largely is dependent upon the program's ability to convince the home school that the student is capable of moving into the curriculum of that school at practically any point. This would be a comfort to the student and parents and, likely, the home school.

SUMMARY

The people associated with and responsible for MEGSSS are to be commended. They have taken a significant step toward meeting a need for a quality program for the highly gifted child. That fact cannot and should not be underestimated. That the program is not perfect does not detract from that fact. MEGSSS not only offers a program to children in the St. Louis area, but it offers a model that can be studied and replicated.

MEGSSS, we find, has many strengths among which are:

1) Attainable, well defined goals and philosophy,
2) Intelligent, articulate, highly motivated students,
3) High quality, dedicated teachers,
4) Excellent parent support,
5) Materials that seem to meet the needs of the gifted and talented student and which provide a stimulating approach to learning advanced topics in mathematics,
6) Challenging and stimulating social setting for the students.

Among the areas of weaknesses in the MEGSSS Program are:

1) Funding is inadequate and/or the program is not cost effective,
2) Identification procedures,
3) Drop-out rate,
4) Teacher training is absent from the program and new qualified teachers may not be available,
5) Logistical problems related to location and class time.
6) Lack of, or weak, local district and university support.

We hope the MEGSSS program can continue and that MEGSSS will build upon its strengths in order to overcome its weaknesses. We think the continuation of MEGSSS could provide an arena for the further investigation of questions raised in or implied by this report such as:

1) Can the EM materials be integrated with other mathematics materials to provide an appropriate curriculum for gifted students yet enable the students to transition smoothly to the home school? (We believe the MEGSSS student will probably not have difficulty making such a transition, but we are convinced that administrators and teachers at the home school view the transition as difficult and thus could cause it to be so for the student.)
2) Can a selection process be found to give a more representative student population?
3) Can such a program exist without such a large drop-out rate?
4) Can a cooperative arrangement be found that will allow the program the necessary autonomy to operate yet provide a level of funding such that parents are not required to provide for the total costs of the program?
5) Can teachers be found or trained to provide the quality of instruction necessary to continue the program?

Also, if MEGSSS can operate through the full six years, there will be some students available to participate in a follow-up study to determine the educational/mathematical outcomes of the Elements of Mathematics Program.

For those who would attempt to replicate MEGSSS, we wish them well. We feel the model is worthy of replication. We hope that what is written here will be helpful. We feel strongly that attention must be paid from the very start to building the broad base of support. This will, hopefully, eliminate some problems

later on in the development of the program. Even so, the replicator should be prepared to face many of the same problems that MEGSSS has faced. Try not to be discouraged by a slow, bumpy start.